



- Platform for impact researchers to explore climate data and perform analysis
- In-depth documentation and guidance
- Use cases from impact researchers
- **Perform calculations / Data processing – WPS**

<http://climate4impact.eu/>



The screenshot shows the IS-ENES climate4impact portal. At the top left is the IS-ENES logo and tagline 'Exploring climate model data'. On the top right, there are links for 'IS-ENES | Contact | Sign in'. Below this is a navigation menu with items: Home, Data discovery, Downscaling, Documentation, Help, About us, Sign in, and a search box. The main heading is 'IS-ENES climate4impact portal'. The content area includes a welcome message, a description of the portal's purpose (providing access to climate model data and tools), and a list of impact and adaptation themes represented by images: Agriculture/Forestry, Energy, Health, Infrastructure/Urban, Marine/Coastal, Nature/Biodiversity, Tourism, and Water Management. A footer contains the European Union flag and text stating that the project has received funding from the European Union's Seventh Framework Programme.

## Online on-demand calculations

- C4I Statistical Downscaling REST API
  - Services provided by the University of Cantabria servers
  - Connected to ESGF
  - Friendly user interface on C4I
- C4I Climate Indices
  - All ETCCDI indices and simple statistics available
  - Native Python open-source ICCLIM software (fully validated against R.climdex)
  - Expandable to climate indicators as well

The screenshot displays the web interface for online on-demand calculations. The interface is organized into several sections:

- Documentation**, **Create**, **Jobs**, **Downscalings** (Navigation tabs)
- Load saved downscalings** (Section header)
- Select your Predictand** (Configuration section):
  - Variable:**  PRECIPITATION,  TEMPERATURE
  - Sub-variables:**  Tmax,  Tmin
  - Domain:**  IBERIA
  - Dataset:**  ECA VALUE\_blend,  GSN World
  - Predictand:** VALUE\_Iberia\_ECA\_Tmax
- Downscaling method validation** (Configuration section):
  - Downscaling methods:**  ALL,  ANALOGUES,  LINEAR\_REGRESSION
  - Method:** Analogues (default)
  - Download validation report** (button)
- Run your Downscaling** (Configuration section):
  - Model:**  CMIP5
  - Models:** CANESM2, CNRM-CM5 (selected), GFDL-ESM2M, IPSL-CM5A-MR, MIROC-ESM, MPI-ESM-MR, NORESM1-M
  - Experiment/RCP:**  Run 1
  - Period:** historical\_r11p1 (selected), rcp45\_r11p1, rcp85\_r11p1
  - Start year:** 1991, **End year:** 2001
  - Actions:** Basket, ESGF search, Save, Downscale
- Downscalings** (Table of results):
 

Job ID	Type	Predictand	Downscaling Method	Model	Experiment	Start year	End year	Status	Operations
41902	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CNRM-CM5	historical_r11p1	1991	2001	Finished	Download
41901	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	GFDL-ESM2M	rcp45_r11p1	2010	2021	Finished	Download
41814	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	historical_r11p1	1991	2001	Finished	Download
41811	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	historical_r11p1	1990	2001	Failed	X
33915	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	rcp85_r11p1	2031	2050	Finished	Download
33914	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	rcp45_r11p1	2021	2030	Finished	Download
33913	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	rcp85_r11p1	2011	2020	Finished	Download
33910	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	historical_r11p1	1991	1901	Finished	Download

**ETCCDI:** The joint CCI/CLIVAR/JCOMM Expert Team (ET) on Climate Change Detection and Indices

## Web Processing Service

- Generic WPS UI
  - Based on Describe Process XML file.
  - Links to basket
  - Selections populated dynamically
- Main WPS Processes
  - Climate indices calculation
  - Subsetting over a large time period
  - Regrid and reformat, extract regions
  - Combine climate indicators (CLIPC)
- Wizards
  - Indices calculation
  - Subsetting / file conversions (planned)

The screenshot displays the 'Processor CLIPC Create statistics per NUTS region Execute' configuration page. The interface includes a navigation menu with options like Home, Data discovery, Downscaling, Documentation, Help, About us, and Account. The main content area shows the processor title, identifier, abstract, and location. A progress bar indicates the processing status: 'Processing: [Starting WCS request 2/2: data](50%)'. Below the processor details, there are sections for 'Processing inputs' with fields for 'File A (input1)', 'File B (input2)', and 'Bounding box (bbox)', each with a text input field and control icons.

# Web Processing Service

Job progress can be viewed from anywhere (also in other portals using the services, e.g. CLIPC)

Account » Monitor jobs

Submitted processing jobs

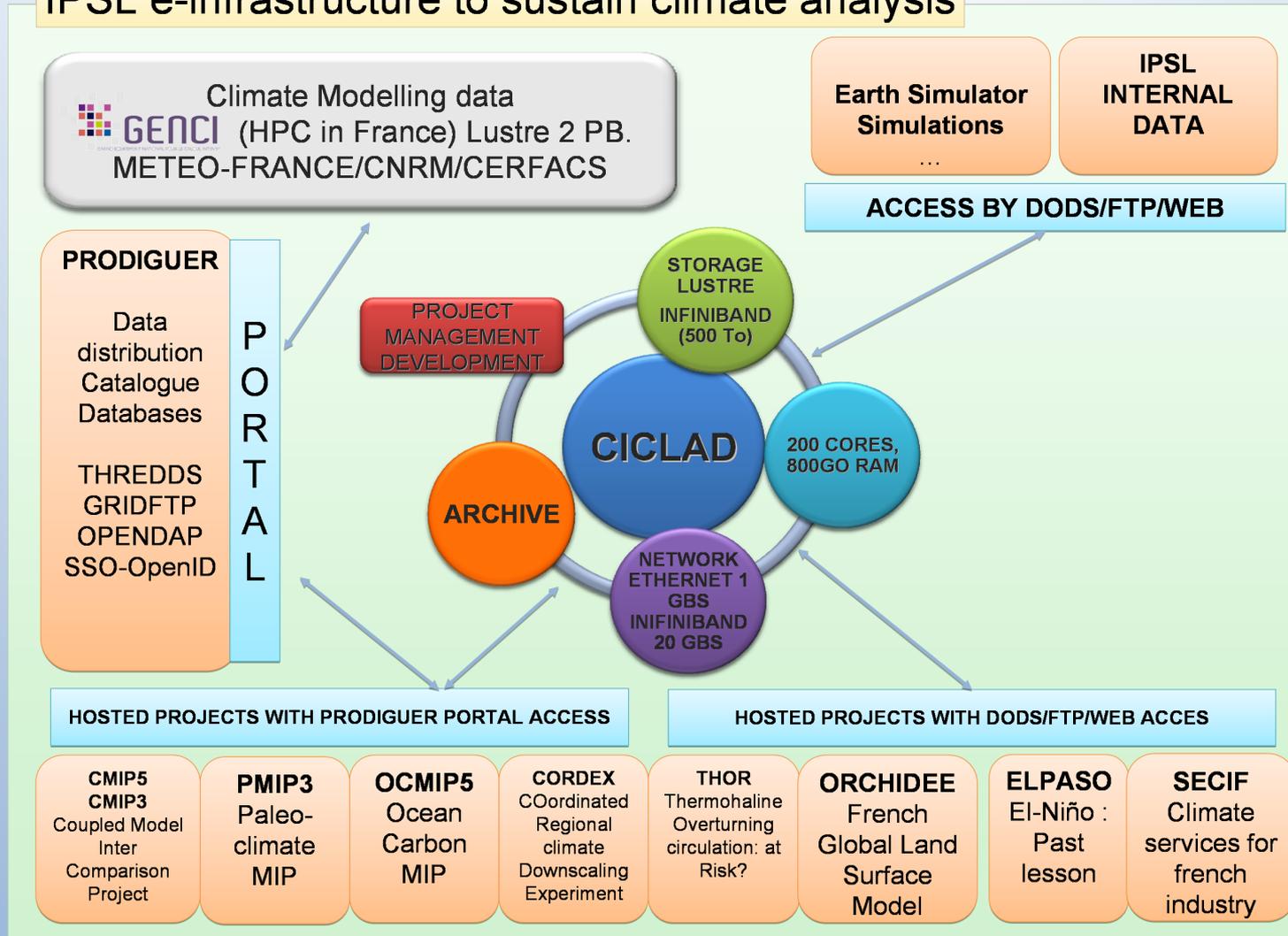
Created at	Name	Status location	Progress	View	X
2016-12-06 20:36:36Z	clipc_extractnuts_execute	<a href="#">pywps-aec7c400-bbf3-11e6-ac70-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-06 20:35:32Z	clipc_simpleindicator_execute	<a href="#">pywps-8835e09c-bbf3-11e6-8874-78e3b502c7d8.xml</a>	failed	<a href="#">view</a>	<a href="#">X</a>
2016-12-06 14:02:50Z	clipc_extractnuts_execute	<a href="#">pywps-ac876b46-bbbc-11e6-86ec-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-05 10:32:43Z	clipc_extractnuts_execute	<a href="#">pywps-27bdecbe-bad6-11e6-96df-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-05 10:32:00Z	clipc_extractnuts_execute	<a href="#">pywps-0ddf0c60-bad6-11e6-92df-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-03 19:25:45Z	knmi_advanced_combine	<a href="#">pywps-4984287a-b98e-11e6-8d4b-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-03 19:24:13Z	clipc_extractnuts_execute	<a href="#">pywps-1266efc6-b98e-11e6-a9ae-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-02 13:16:55Z	clipc_combine_identify	<a href="#">pywps-98511b00-b891-11e6-9307-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-02 12:55:03Z	knmi_advanced_combine	<a href="#">pywps-8a6e920e-b88e-11e6-b96f-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>
2016-12-02 10:28:06Z	clipc_extractnuts_execute	<a href="#">pywps-03058ed0-b87a-11e6-a30f-78e3b502c7d8.xml</a>	ready	<a href="#">view</a>	<a href="#">X</a>

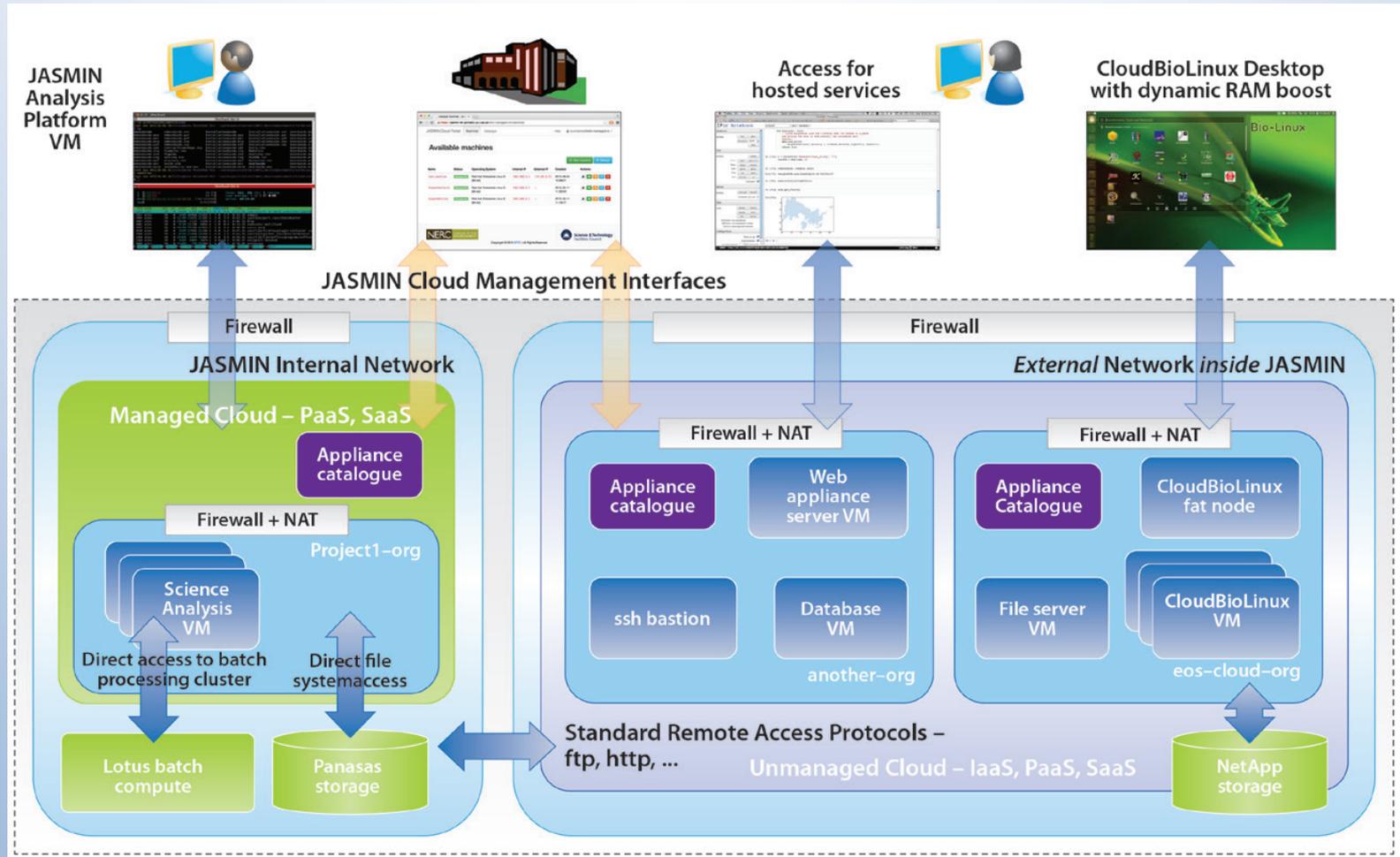
## Calculations near storage (or away from user's servers)

- **Dedicated high performance systems**
  - Replicate all needed data onto one large data service: all local data only
  - Expose services through standard protocols (http REST, WPS, OpenDAP, ...)
  - Give (selected) users command-line access
- **Remote Computing Services**
  - Expose computing services
  - Grab remote data and perform calculations on remote high capacity servers/clusters
  - Only send results to users
- **Central Computing Platform**
  - Portal/platform with standard services (WPS, ...)
  - Orchestrate calculations with, when possible, delegations to external services (computations, storage)
  - Grab results, and make available to users with more services (visualization, quicklook, download, ...)



## IPSL e-infrastructure to sustain climate analysis

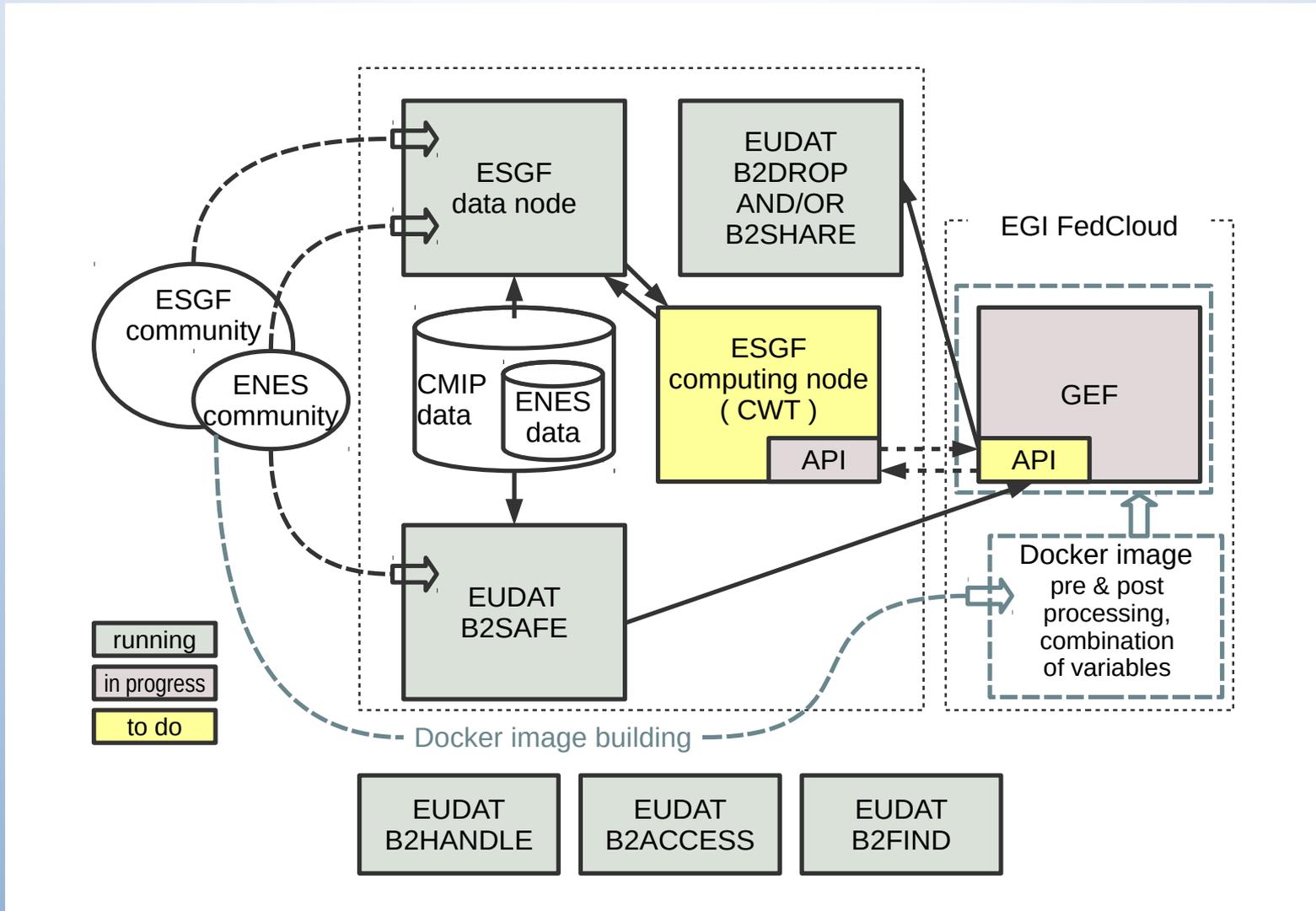




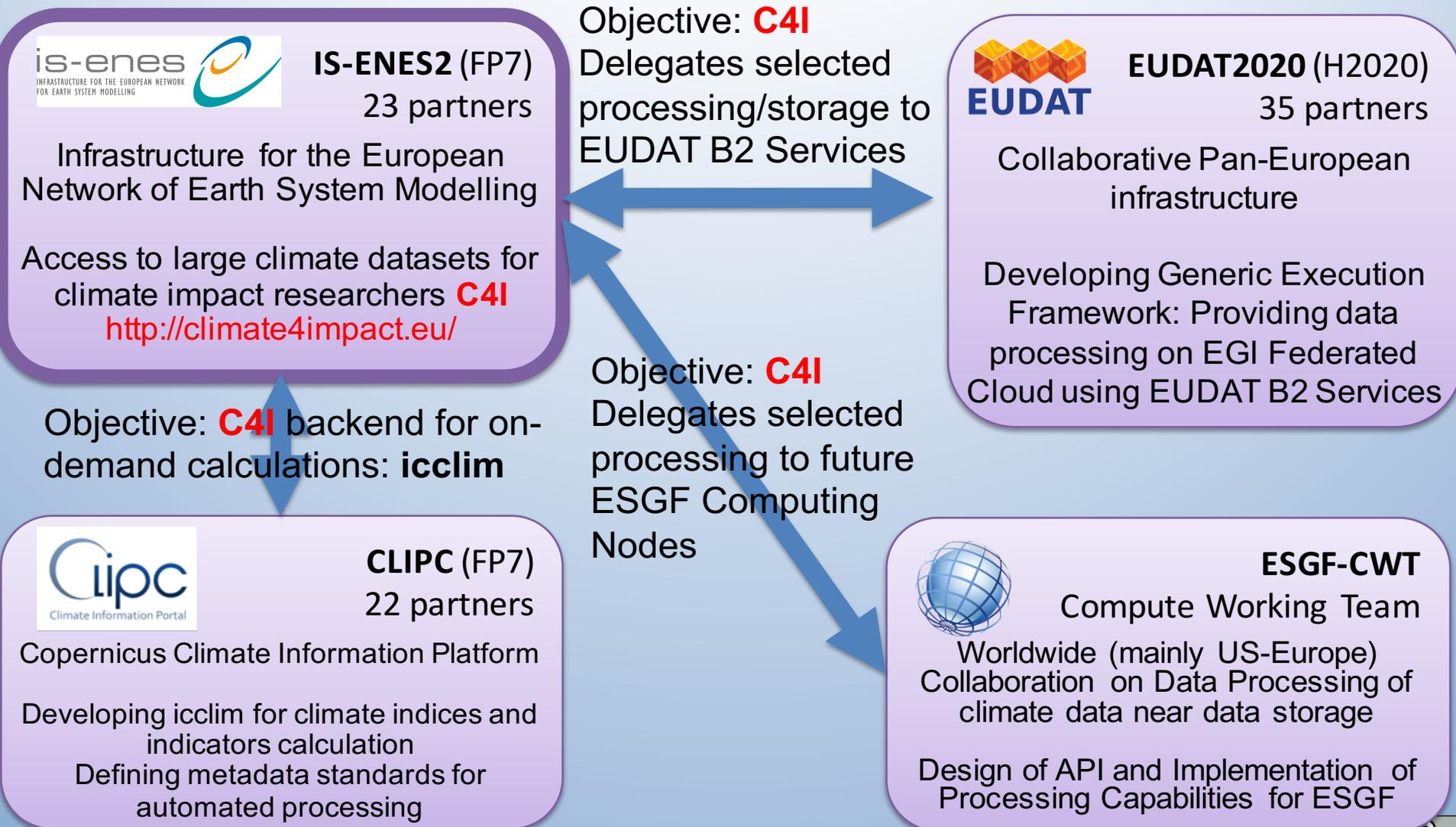
**Fig. 13. CEDA's JASMIN analysis platform.** JASMIN integrates cloud architecture, container technologies, and virtual machines to improve flexibility and performance and track maintenance.



# Delegations of some calculations; integration of services



## Background: Integration of European and International projects



## Conclusion and next steps

- ESGF + climate4impact enables impact research
  - Requires ESGF Search API, OpenDAP and THREDDS catalogs
  - Climate4impact processing, search and visualization is a layer over ESGF
  - Support of Downscaling ESGF datasets on the fly
- Climate4impact is flexible due to applied technologies and standards
  - PyWPS with ICCLIM as generic processing framework for climate indices
  - ADAGUC WMS can be used to visualize local and remote files
  - OPeNDAP can be used to access small bits of large files over the internet
  - Many APIs developed to integrate C4I services into CLIPC portal  
<https://dev.knmi.nl/projects/impactportal/wiki/API>
- Next steps
  - Implement more use cases from climate impact researchers
  - Climate indices calculation wizard
  - File abstraction: focus on physical parameters

## Sustainability Issues

- CLIPC and IS-ENES2 ending
  - Currently 2-3 Coding Sprints per year for development and implementation: needed to improve but not only.
  - Very good core of dev people within IS-ENES2/CLIPC
  - Long to-do list based on user requirements
- What will happen after?
  - New project proposals to further develop and use the C4I platform
  - Limited staff, but we want to continue working together (own institutes funding, related projects)
  - Will need to adapt the platform and portal to future ESGF changes
  - Involvement in ESGF CWT will continue
  - Will need to tackle new datasets, new projects, CMIP6 and +
  - More dissemination needed
  - Support to users
  - Improvements
  - Delegate calculations to ESGF Computing Nodes, External Computing Resources (EGI, Ophidia, etc.)



<http://climate4impact.eu/>

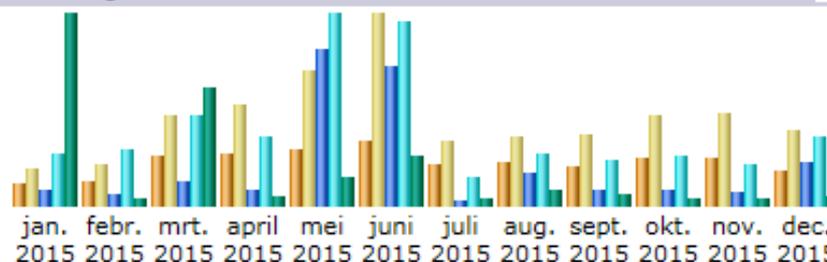
<http://icclim.readthedocs.org/>

## Samenvatting

<b>Rapportageperiode</b>	Maand jan. 2015				
<b>Eerste bezoek</b>	01 jan. 2015 - 01.16				
<b>Laatste bezoek</b>	31 jan. 2015 - 23.24				
	<b>Unieke bezoekers</b>	<b>Aantal bezoeken</b>	<b>Pagina's</b>	<b>Hits</b>	<b>Bytes</b>
Bekeken verkeer *	<b>1002</b>	<b>1644</b> (1.64 bezoeken/bezoeker)	<b>43149</b> (26.24 Pagina's/bezoek)	<b>142263</b> (86.53 Hits/bezoek)	<b>48.08 GB</b> (30668.11 KB/bezoek)
Niet-bekeken verkeer *			<b>80506</b>	<b>82125</b>	<b>3.66 GB</b>

\* „Niet bekeken” is verkeer dat gegenereerd werd door robots of worms, of respons met een speciale HTTP-statuscode.

## Maandelijkse historie



Maand	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
jan. 2015	1002	1644	43149	142263	48.08 GB
febr. 2015	1059	1855	32931	153179	1.90 GB
mrt. 2015	2186	3923	64718	247721	29.51 GB
april 2015	2255	4430	41533	187479	2.46 GB
mei 2015	2490	5920	429910	525534	7.25 GB
juni 2015	2843	8358	383313	505838	12.60 GB
juli 2015	1806	2819	15752	81211	2.01 GB
aug. 2015	1907	3027	91892	145005	4.20 GB
sept. 2015	1688	3099	42509	123899	2.82 GB
okt. 2015	2074	3924	43705	139625	2.08 GB
nov. 2015	2049	4019	39164	115474	1.85 GB
dec. 2015	1497	3317	122402	191622	2.50 GB
<b>Totaal</b>	<b>22856</b>	<b>46335</b>	<b>1350978</b>	<b>2558850</b>	<b>117.26 GB</b>

## Samenvatting

<b>Rapportageperiode</b>	Maand jan. 2016				
<b>Eerste bezoek</b>	01 jan. 2016 - 00.00				
<b>Laatste bezoek</b>	31 jan. 2016 - 23.54				
	<b>Unieke bezoekers</b>	<b>Aantal bezoeken</b>	<b>Pagina's</b>	<b>Hits</b>	<b>Bytes</b>
Bekeken verkeer *	<b>1556</b>	<b>3063</b> (1.96 bezoeken/bezoeker)	<b>193052</b> (63.02 Pagina's/bezoek)	<b>319625</b> (104.35 Hits/bezoek)	<b>4.21 GB</b> (1441.05 KB/bezoek)
Niet-bekeken verkeer *			<b>159418</b>	<b>161593</b>	<b>3.08 GB</b>

\* „Niet bekeken” is verkeer dat gegenereerd werd door robots of worms, of respons met een speciale HTTP-statuscode.

## Maandelijks historie

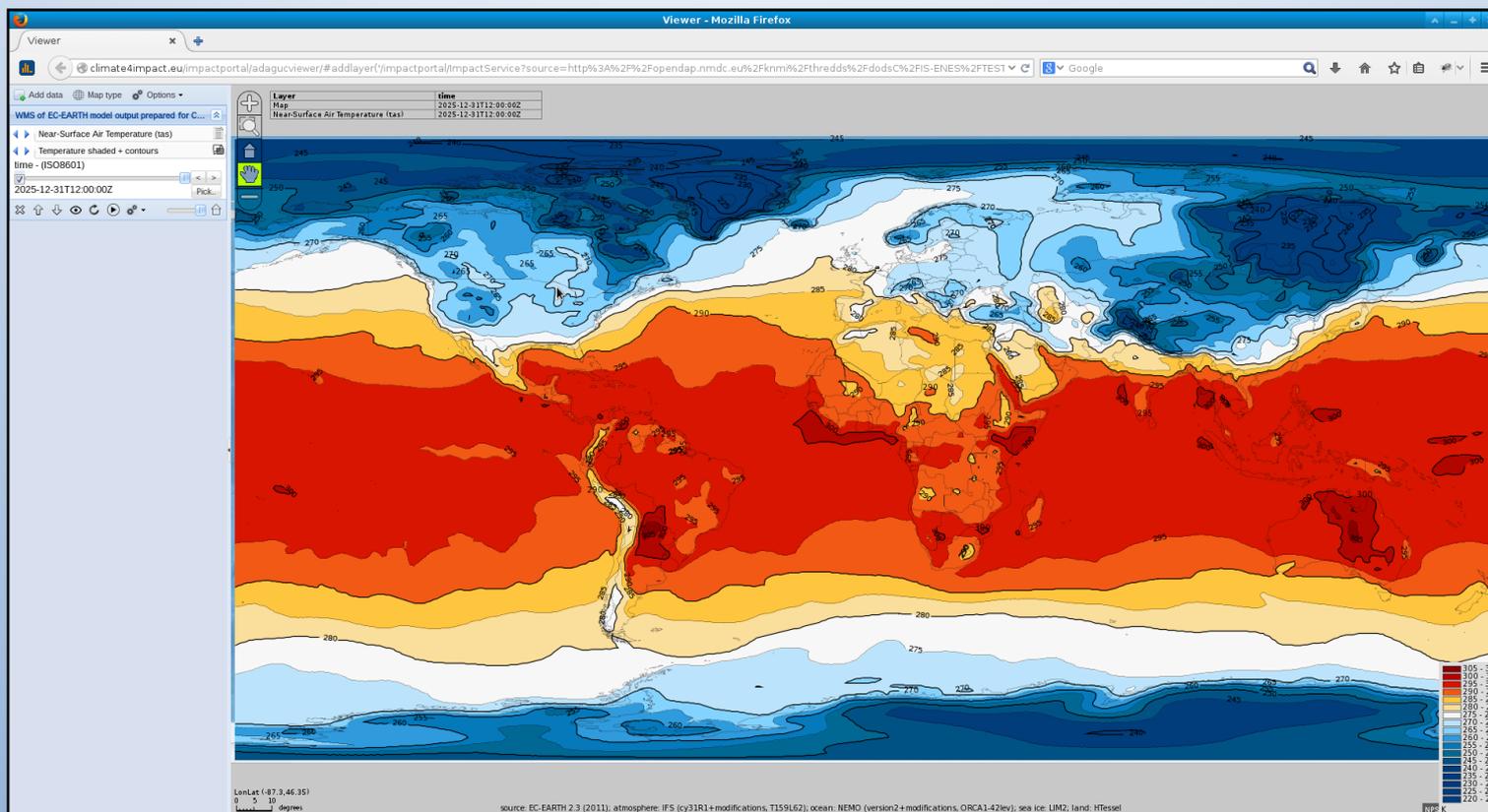


jan. 2016 **febr. 2016** mrt. 2016 april 2016 mei 2016 juni 2016 juli 2016 aug. 2016 sept. 2016 okt. 2016 nov. 2016 dec. 2016

Maand	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
jan. 2016	1556	3063	193052	319625	4.21 GB
<b>febr. 2016</b>	955	1684	73453	154556	2.22 GB
mrt. 2016	0	0	0	0	0
april 2016	0	0	0	0	0
mei 2016	0	0	0	0	0
juni 2016	0	0	0	0	0
juli 2016	0	0	0	0	0
aug. 2016	0	0	0	0	0
sept. 2016	0	0	0	0	0
okt. 2016	0	0	0	0	0
nov. 2016	0	0	0	0	0
dec. 2016	0	0	0	0	0
<b>Totaal</b>	<b>2511</b>	<b>4747</b>	<b>266505</b>	<b>474181</b>	<b>6.43 GB</b>

## Use of open standards and open source software

- Data access over OPeNDAP → THREDDS
- Online analysis using WPS → PyWPS and CERFACS ICCLIM
- Online visualization using WMS → KNMI ADAGUC
- Single Sign On using OpenID, and OAuth2, delegation using MyProxy X509



## Search using ESGF Search API – New faceted search

The screenshot displays the is-enes search interface. At the top, there is a search bar with the text "search.jsp#" and a search icon. Below the search bar, the is-enes logo and tagline "Exploring climate model data" are visible. A navigation menu includes links for Home, Data discovery, Downscaling, Documentation, Help, About us, and Account. A secondary menu shows Search, Catalogs, Explore your own catalogs or files, Map & Plot, and Processing.

The main section is titled "Filters" and includes a "Help" link. It shows several filter categories: Project (23), Parameter (1721), Frequency (16), Experiment (177), Domain (30), Model (142), Date, Geobox, and Free text. There are buttons for "show all filters" and "clear all filters".

A "Quick select Parameter" panel is open, showing "All Parameter properties (1721)". It contains several categories of parameters, each with a list of checkboxes:

- Temperature** (orange header):
  - Temperature (tas)
  - Min. Temperature (tasmin)
  - Max. Temperature (tasmax)
  - Air Temperature (ta)
- Precipitation** (blue header):
  - Precip. (pr)
  - Conv. Precip. (prc)
  - Snow (prsn)
- Humidity** (green header):
  - Specific Humidity (huss)
  - Rel. Humidity (hurs)
  - Max. Rel. Humidity
  - Min. Rel. Humidity (rhsmín)
  - Rel. Humidity (rhs)
  - Spec. Humidity (hus)
  - Rel. Humidity (hur)
- Wind** (yellow header):
  - Wind (sfcWind)
  - Max. Wind (sfcWindmax)
  - E. Wind (uas)
  - N. Wind (vas)
- Radiation** (red header):
  - SW Radiation Dn (rsds)
  - SW Radiation Up (rsus)
  - LW Radiation Dn (rlids)
  - LW Radiation Up (rlus)
  - Diff. Radiation Dn (rsdsdiff)
  - Clouds (clt)
- Pressure** (purple header):
  - Pressure (ps)
  - SL Pressure (psl)
  - Pressure (pfull)
- Evaporation** (orange header):
  - Act. Evap. (evspsbl)
  - Pot. Evap. (evspsblpot)
  - Soil Evap. (evspsblsoi)
  - Canopy Evap. (evspsblveg)

Below the parameter selection, there is a "Selected filters" section showing "none". A status bar indicates "Found 672402 datasets. Displaying page 1 of 26897." Navigation buttons include "Previous", "Next", and "Export to CSV". The bottom of the page shows a list of dataset entries, each with a play button icon, a trash icon, and the dataset name, followed by the "es-doc" logo.

## Search using ESGF Search API – **New** faceted search

- Search interface has been improved based on feedback from impact users
- Search interface speed has greatly been improved by using short lived (1 minute) caches
- Improved error handling in C4I for ESGF data nodes, catalogs are checked in advance for availability. Catalog status is clearly indicated to the user.
- Started with handling search queries as an aggregated dataset, e.g. use a search query as input for your processing.

## Download

- By default the basket contains:
  - “Remote data” for links
  - “My data” for your own data
- Script based download: select and batch download multiple files
- The basket allows for uploading your own files
  - Can be used in processing or visualization
  - A per-user OpenDAP server on files in user's basket
- In development: **abstraction of the file concept. Packaging results.**

The screenshot shows the 'Basket' page in the Climate4Impact web application. The page is titled 'Account > Basket' and displays a table of files. The table has columns for 'File', 'DAP', 'HTTP', 'Filesize', and 'Date'. The files are categorized into 'Remote data' and 'My data'. The 'Remote data' section includes files like '0.50 deg. regular grid', '0.44 deg. rotated grid', and several 'tasmax\_day\_IPSL-CM5A-LR\_historical\_r1i1p1' files. The 'My data' section includes 'polar\_stereo\_m.nc' and 'tas\_WAS-44\_ECMWF-ERAINT\_evaluation\_r1i1p1\_IITM-RegCM4-1\_v411\_mon\_198901-199012.nc'. The interface includes navigation tabs, a search bar, and a footer with the IS-ENES logo and funding information.

File	DAP	HTTP	Filesize	Date
Remote data				
0.50 deg. regular grid				2015-01-22...
0.44 deg. rotated grid				2015-01-22...
tx_0.44deg_rot_v10.0.nc	true		691.9M	2015-01-22...
tn_0.44deg_rot_v10.0.nc	true		691.9M	2015-01-22...
tg_0.44deg_rot_v10.0.nc	true		691.9M	2015-01-22...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_18500101-18991231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_18500101-19491231.nc	true	true	1.346G	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19000101-19491231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19500101-19991231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19500101-20051231.nc	true	true	754.0M	2015-03-19...
tasmax_AFR-44_CNRM-CERFACS-CNRM-CM5_rcp45_r1i1p1_CLMcom-CCLM4-8-17_v1_day_2096	true			2015-04-01...
My data				
polar_stereo_m.nc	true	true	906.824K	2015-01-23...
tas_WAS-44_ECMWF-ERAINT_evaluation_r1i1p1_IITM-RegCM4-1_v411_mon_198901-199012.nc	true	true	2.314M	2015-01-23...
tas_WAS-44_ECMWF-ERAINT_evaluation_r1i1p1_IITM-RegCM4-1_v411_day_19890101-19901231	true	true	70.463M	2015-01-23...